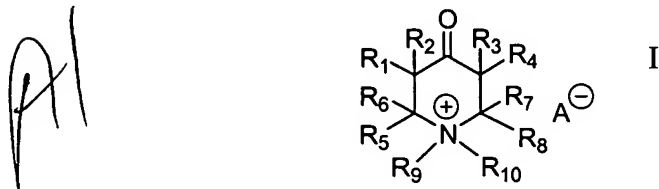


## IN THE CLAIMS:

1. (Currently Amended) A method of producing mostly 5 $\beta$ ,6 $\beta$ -epoxides of steroids from  $\Delta^5$ -unsaturated steroids by an epoxidation reaction using a ketone and an oxidizing agent under conditions effective to generate epoxides,

wherein said ketone is selected from compounds of generic formula I,



$R_1$  or  $R_4$  in formula (I) is selected from alkyl, halogenated alkyl, aryl,  $\Theta R \underline{R}_y$  (where  $\underline{R}_y = H$ , alkyl or aryl),  $\Theta \underline{C} \underline{O} \underline{R} \underline{O} \underline{C} \underline{O} \underline{R}_y$  (where  $\underline{R}_y = H$ , alkyl or aryl),  $\Theta \underline{C} \underline{O} \underline{O} \underline{R} \underline{O} \underline{C} \underline{O} \underline{R}_y$  (where  $\underline{R}_y = \text{alkyl or aryl}$ ),  $\underline{O} \underline{C} \underline{O} \underline{O} \underline{C} \underline{H}_2 \underline{R}_z$  (where  $\underline{R}_z = \text{aryl}$ ),  $\Theta \underline{C} \underline{O} \underline{N} \underline{R}_1 \underline{R}_2 \underline{O} \underline{C} \underline{O} \underline{N} \underline{R}_u \underline{R}_v$  (where  $\underline{R}_1 \underline{R}_u$  or  $\underline{R}_2 \underline{R}_v = H$ , alkyl or aryl),  $\Theta \underline{S} \underline{i} \underline{R}_1 \underline{R}_2 \underline{R}_3 \underline{O} \underline{S} \underline{i} \underline{R}_w \underline{R}_x \underline{R}_y$  (where  $\underline{R}_1 \underline{R}_w$ ,  $\underline{R}_2 \underline{R}_x$  or  $\underline{R}_3 \underline{R}_y = \text{alkyl or aryl}$ ), and halogen;

$R_2$  or  $R_3$  in formula (I) is selected from H, alkyl, halogenated alkyl, aryl,  $\Theta R \underline{R}_y$  (where  $\underline{R}_y = H$ , alkyl or aryl),  $\Theta \underline{C} \underline{O} \underline{R} \underline{O} \underline{C} \underline{O} \underline{R}_y$  (where  $\underline{R}_y = H$ , alkyl or aryl),  $\Theta \underline{C} \underline{O} \underline{O} \underline{R} \underline{O} \underline{C} \underline{O} \underline{R}_y$  (where  $\underline{R}_y = \text{alkyl or aryl}$ ),  $\underline{O} \underline{C} \underline{O} \underline{O} \underline{C} \underline{H}_2 \underline{R}_z$  (where  $\underline{R}_z = \text{aryl}$ ),  $\Theta \underline{C} \underline{O} \underline{N} \underline{R}_1 \underline{R}_2 \underline{O} \underline{C} \underline{O} \underline{N} \underline{R}_u \underline{R}_v$  (where  $\underline{R}_1 \underline{R}_u$  or  $\underline{R}_2 \underline{R}_v = H$ , alkyl or aryl),  $\Theta \underline{S} \underline{i} \underline{R}_1 \underline{R}_2 \underline{R}_3 \underline{O} \underline{S} \underline{i} \underline{R}_w \underline{R}_x \underline{R}_y$  (where  $\underline{R}_1 \underline{R}_w$ ,  $\underline{R}_2 \underline{R}_x$  or  $\underline{R}_3 \underline{R}_y = \text{alkyl or aryl}$ ), and halogen;

$R_5$ ,  $R_6$ ,  $R_7$  or  $R_8$  in formula (I) is selected from H, alkyl, halogenated alkyl, aryl,  $\underline{C} \underline{O} \underline{O} \underline{R} \underline{C} \underline{O} \underline{O} \underline{R}_y$  (where  $\underline{R}_y = H$ , alkyl or aryl), and  $\underline{C} \underline{O} \underline{N} \underline{R}_1 \underline{R}_2 \underline{C} \underline{O} \underline{N} \underline{R}_u \underline{R}_v$  (where  $\underline{R}_1 \underline{R}_u$  or  $\underline{R}_2 \underline{R}_v = H$ , alkyl or aryl);

$R_9$  or  $R_{10}$  in formula (I) is selected from alkyl, halogenated alkyl, and aryl; and

A in formula (I) is selected from halogen, OTf, BF<sub>4</sub>, OAc, NO<sub>3</sub>, BPh<sub>4</sub>, PF<sub>6</sub>, and SbF<sub>6</sub>.

2. (Original) The method of claim 1 wherein said oxidizing reagent is selected from the group consisting of potassium peroxomonosulfate, sodium hypochlorite, sodium perborate, hydrogen peroxide, and peracids.

*Amended*  
3. (Original) The method of claim 2 wherein said epoxidation reaction is carried out using potassium peroxomonosulfate as an oxidizing agent.

4. (Currently Amended) The method of claim 1 wherein said epoxidation reaction is carried out in a homogeneous solvent system ~~containing~~selected from dimethoxymethane-acetonitrile-water, acetonitrile-water, acetone-water, dioxane-water, dimethoxyethane-water, and tetrahydrofuran-water, or a biphasic solvent system ~~containing~~selected from dichloromethane-water, chloroform-water, benzene-water, toluene-water, dimethoxymethane-water, or diethylether-water, or mixtures thereof.

5. (Original) The method of claim 1 wherein said epoxidation reaction is carried out at a temperature within the range from about -10 °C to about 40 °C.

6. (Original) The method of claim 5 wherein said epoxidation reaction is carried out at room temperature.

7. (Original) The method of claim 1 wherein said epoxidation reaction is carried out at a pH within the range from about 7.0 to about 12.0.

8. (Original) The method of claim 7 wherein said pH is within the range from about 7.0 to about 7.5.

9. (Original) The method of claim 7 wherein said pH is controlled by using a pH-stat or a buffer.

10. (Currently Amended) The method of claim 9 wherein said buffer is selected from the ~~solutions~~group consisting of solutions of sodium bicarbonate, sodium carbonate, sodium borate, sodium hydrogenphosphate, sodium dihydrogenphosphate, sodium hydroxide, potassium hydrogenphosphate, potassium dihydrogenphosphate, potassium bicarbonate, potassium carbonate, potassium hydroxide, ~~or~~and mixtures thereof.

11. (Original) The method of claim 1 wherein said epoxidation reaction provides said epoxides in at least about 5:1  $\beta/\alpha$ -epoxide ratio.

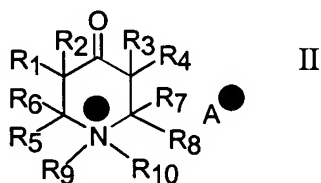
12. (Original) A method of producing mostly 5 $\beta$ ,6 $\beta$ -epoxides of steroids from  $\Delta^5$ -unsaturated steroids having a substituent at the 3 $\alpha$ -position by an epoxidation reaction using a ketone and an oxidizing agent under conditions effective to generate epoxides.

13. (Currently Amended) The method of claim 12 wherein said substituent is selected from  $OR_y$  (where  $R_y = H$ , alkyl or aryl),  $O(CH_2)_nOR_y$  (where  $n = 1, 2$  or  $3$ ,  $R_y = H$ , alkyl or aryl),  $O(CH_2)_mSO_nR_y$  (where  $n = 1, 2$  or  $3$ ;  $m = 0, 1$  or  $2$ ;  $R_y = H$ , alkyl or aryl),  $OSiR_1R_2R_3$ ,  $OSiR_wR_xR_y$  (where  ~~$R_1, R_2$  or  $R_3$~~   $R_w, R_x$  or  $R_y$  = alkyl or aryl),  $OSO_nR_y$  (where  $n = 0, 1$  or  $2$ ;  $R_y = H$ , alkyl or aryl),  $OCO_nR_y$  (where  $n = 1$  or  $2$ ;  $R_y = H$ , alkyl or aryl),  $OCONR_1R_2$ ,  $OCONR_uR_v$  (where  ~~$R_1$  or  $R_2$~~   $R_u$  or  $R_v$  =  $H$ , alkyl or aryl),  $OPO_nR_y$  (where ~~where~~  $n = 2$  or  $3$ ;  $R_y =$  alkyl or aryl),  $NR_1R_2$ ,  $NR_uR_v$  (where  ~~$R_1$  or  $R_2$~~   $R_u$  or  $R_v$  =  $H$ ,

alkyl or aryl),  $\text{NR}_1\text{CO}_n\text{R}_2$   $\text{NR}_u\text{CO}_n\text{R}_v$  (where  $n = 1$  or  $2$ ;  $\text{R}_1$  or  $\text{R}_2$   $\text{R}_u$  or  $\text{R}_v = \text{H}$ , alkyl or aryl),  $\text{NR}_1\text{CONR}_2\text{R}_3$   $\text{NR}_u\text{CONR}_v\text{R}_w$  (where  $\text{R}_1$ ,  $\text{R}_2$  or  $\text{R}_3$   $\text{R}_u$ ,  $\text{R}_v$  or  $\text{R}_w = \text{H}$ , alkyl or aryl),  $\text{NR}_1\text{SO}_n\text{R}_2$   $\text{NR}_u\text{SO}_n\text{R}_v$  (where  $n = 1$  or  $2$ ;  $\text{R}_1$   $\text{R}_v = \text{H}$ , alkyl or aryl,  $\text{R}_2$   $\text{R}_w = \text{alkyl or aryl}$ ),  $\text{NPhth}$  (Phth = phthaloyl group),  $^+\text{NR}_1\text{R}_2\text{R}_3$   $^+\text{NR}_u\text{R}_v\text{R}_w$  (where  $\text{R}_1$ ,  $\text{R}_2$  or  $\text{R}_3$   $\text{R}_u$ ,  $\text{R}_v$  or  $\text{R}_w = \text{H}$ , alkyl or aryl),  $\text{SiR}_1\text{R}_2\text{R}_3$   $\text{SiR}_u\text{R}_v\text{R}_w$  (where  $\text{R}_1$ ,  $\text{R}_2$  or  $\text{R}_3$   $\text{R}_u$ ,  $\text{R}_v$  or  $\text{R}_w = \text{H}$ , alkyl or aryl),  $\text{SO}_n\text{R}_v$  (where  $n = 0, 1$  or  $2$ ;  $\text{R}_v = \text{H}$ , alkyl or aryl),  $\text{SCO}_n\text{R}_v$  (where  $n = 1$  or  $2$ ;  $\text{R}_v = \text{H}$ , alkyl or aryl), halogen, CN,  $\text{NO}_2$ , alkyl, aryl,  $\text{COOR}_v$  (where  $\text{R}_v = \text{H}$ , alkyl or aryl), and  $\text{CONR}_1\text{R}_2$   $\text{CONR}_u\text{R}_v$  (where  $\text{R}_1$  or  $\text{R}_2$   $\text{R}_u$  or  $\text{R}_v = \text{H}$ , alkyl or aryl).

14. (Original) The method of claim 12 wherein said  $\Delta^5$ -unsaturated steroid having a substituent at the  $3\alpha$ -position is selected from the group consisting of  $\Delta^5$ -unsaturated steroids having a ketal derivative of ketone group or a thioketal derivative of ketone group at the 3-position.

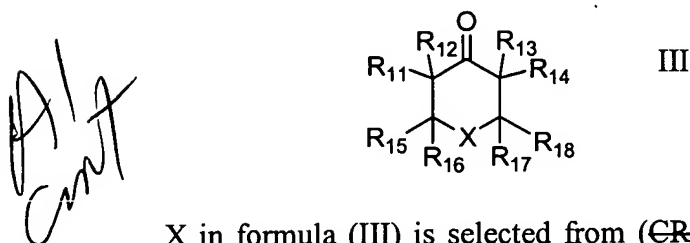
15. (Currently Amended) The method of claim 12 wherein said ketone is selected from the group consisting of compounds of generic formula II, III, IV, and V wherein



$\text{R}_1$ ,  $\text{R}_2$ ,  $\text{R}_3$ , or  $\text{R}_4$  in formula (II) is selected from H, alkyl, halogenated alkyl, aryl,  $\text{OROR}_v$  (where  $\text{R}_v = \text{H}$ , alkyl or aryl),  $\text{OCOROCOR}_v$  (where  $\text{R}_v = \text{H}$ , alkyl or aryl),  $\text{OCOROCOR}_v$  (where  $\text{R}_v = \text{alkyl or aryl}$ ),  $\text{CONR}_1\text{R}_2$   $\text{CONR}_u\text{R}_v$  (where  $\text{R}_1$   $\text{R}_u$  or  $\text{R}_2$   $\text{R}_v = \text{H}$ , alkyl or aryl),  $\text{OSiR}_1\text{R}_2\text{R}_3$   $\text{OSiR}_u\text{R}_v\text{R}_w$  (where  $\text{R}_1$ ,  $\text{R}_u$ ,  $\text{R}_2$   $\text{R}_v$  or  $\text{R}_3$   $\text{R}_w = \text{alkyl or aryl}$ ), and halogen;

$R_5, R_6, R_7, R_8, R_9$  or  $R_{10}$  in formula (II) is selected from H, alkyl, halogenated alkyl, aryl,  $\text{COORCOOR}_v$  (where  $\text{RR}_v = \text{H, alkyl or aryl}$ ), and  $\text{CONR}_1\text{R}_2\text{CONR}_u\text{R}_v$  (where  $\text{R}_1\text{R}_u$  or  $\text{R}_2\text{R}_v = \text{H, alkyl or aryl}$ );

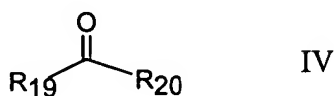
A in formula (II) is selected from halogen, OTf,  $\text{BF}_4$ , OAc,  $\text{NO}_3$ ,  $\text{BPh}_4$ ,  $\text{PF}_6$ , and  $\text{SbF}_6$ ;



X in formula (III) is selected from  $(\text{CR}_1\text{R}_2\text{CR}_u\text{R}_v)_n$  (where  $n = 1, 2, 3, 4, \text{ or } 5$ ;  $\text{R}_1\text{R}_u$  or  $\text{R}_2\text{R}_v = \text{H, alkyl or aryl}$ ), O, S, SO,  $\text{SO}_2$ , and  $\text{NRNR}_v$  (where  $\text{RR}_v = \text{H, alkyl or aryl}$ );

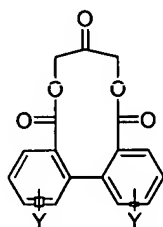
$R_{11}, R_{12}, R_{13}, \text{ or } R_{14}$  in formula (III) is selected from H, alkyl, halogenated alkyl, aryl,  $\text{OROR}_v$  (where  $\text{RR}_v = \text{H, alkyl or aryl}$ ),  $\text{OCOROCOR}_v$  (where  $\text{RR}_v = \text{H, alkyl or aryl}$ ),  $\text{OCOOROCOOR}_v$  (where  $\text{RR}_v = \text{alkyl or aryl}$ ),  $\text{OCONR}_1\text{R}_2\text{OCONR}_u\text{R}_v$  (where  $\text{R}_1\text{R}_u$  or  $\text{R}_2\text{R}_v = \text{H, alkyl or aryl}$ ),  $\text{OSiR}_1\text{R}_2\text{OSiR}_w\text{R}_x\text{R}_y$  (where  $\text{R}_1\text{R}_w, \text{R}_2\text{R}_x \text{ or } \text{R}_3\text{R}_y = \text{alkyl or aryl}$ ), and halogen;

$R_{15}, R_{16}, R_{17}, \text{ or } R_{18}$  in formula (III) is selected from H, alkyl, halogenated alkyl, aryl,  $\text{COORCOOR}_v$  (where  $\text{RR}_v = \text{H, alkyl or aryl}$ ), and  $\text{CONR}_1\text{R}_2\text{CONR}_u\text{R}_v$  (where  $\text{R}_1\text{R}_u$  or  $\text{R}_2\text{R}_v = \text{H, alkyl or aryl}$ );



$R_{19}$  or  $R_{20}$  in formula (IV) is selected from alkyl, halogenated alkyl, aryl,  $\text{CR}_1\text{R}_2\text{OCOR}_3\text{CR}_4\text{R}_5\text{OCOR}_6$  (where  $\text{R}_1, \text{R}_5, \text{R}_2, \text{R}_4$  or  $\text{R}_3, \text{R}_6 = \text{H}$ , alkyl or aryl),  $\text{CR}_1\text{R}_2\text{OCOO}\text{R}_3\text{CR}_4\text{R}_5\text{OCOO}\text{R}_6$  (where  $\text{R}_1, \text{R}_4$  or  $\text{R}_2, \text{R}_5 = \text{H}$ , alkyl or aryl;  $\text{R}_3, \text{R}_6 = \text{alkyl or aryl}$ ),  $\text{CR}_1\text{R}_2\text{NR}_3\text{COOR}_4\text{CR}_5\text{R}_6\text{NR}_7\text{COOR}_8$  (where  $\text{R}_1, \text{R}_5, \text{R}_2, \text{R}_4$  or  $\text{R}_3, \text{R}_6 = \text{H}$ , alkyl or aryl,  $\text{R}_7, \text{R}_8 = \text{alkyl or aryl}$ ),  $\text{CR}_1\text{R}_2\text{NR}_3\text{COR}_4\text{CR}_5\text{R}_6\text{NR}_7\text{COR}_8$  (where  $\text{R}_1, \text{R}_2, \text{R}_3, \text{R}_5, \text{R}_6, \text{R}_7, \text{R}_8 = \text{H}$ , alkyl or aryl), and  $\text{CR}_1\text{R}_2\text{NR}_3\text{SO}_2\text{R}_4\text{CR}_5\text{R}_6\text{NR}_7\text{SO}_2\text{R}_8$  (where  $\text{R}_1, \text{R}_2, \text{R}_3, \text{R}_5, \text{R}_6, \text{R}_7, \text{R}_8 = \text{H}$ , alkyl or aryl;  $\text{R}_4, \text{R}_8 = \text{alkyl or aryl}$ ); and

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Y in formula (V) is selected from H, alkyl, halogenated alkyl, aryl,  $\text{NO}_2$ , CN, F, Cl, Br, I,  $\text{COOR}_q$  (where  $\text{R}_q = \text{H}$  or alkyl),  $\text{OR}_v$  (where  $\text{R}_v = \text{H}$ , alkyl or aryl),  $\text{OSO}_2\text{R}_v$  (where  $\text{R}_v = \text{H}$ , alkyl or aryl),  $\text{OSOR}_v$  (where  $\text{R}_v = \text{H}$ , alkyl or aryl),  $\text{OSR}_v$  (where  $\text{R}_v = \text{H}$ , alkyl or aryl),  $\text{SO}_2\text{R}_v$  (where  $\text{R}_v = \text{H}$ , alkyl or aryl),  $\text{SO}_3\text{R}_v$  (where  $\text{R}_v = \text{H}$ , alkyl or aryl),  $\text{SOON}$   $\text{R}_1\text{R}_2$   $\text{R}_u\text{R}_v$  (where  $\text{R}_1, \text{R}_u$  or  $\text{R}_2, \text{R}_v = \text{H}$ , alkyl or aryl),  $\text{NR}_1\text{SOOR}_2$   $\text{NR}_v\text{SOOR}_v$  (where  $\text{R}_1, \text{R}_v = \text{H}$ , alkyl or aryl;  $\text{R}_2, \text{R}_v = \text{alkyl or aryl}$ ),  $\text{NR}_1\text{SOR}_2$   $\text{NR}_v\text{SOR}_v$  (where  $\text{R}_1, \text{R}_v = \text{H}$ , alkyl or aryl;  $\text{R}_2, \text{R}_v = \text{alkyl or aryl}$ ),  $\text{CR}_1\text{R}_2\text{OR}_3$   $\text{CR}_4\text{R}_5\text{OR}_6$  (where  $\text{R}_1, \text{R}_2, \text{R}_3, \text{R}_4, \text{R}_5$  or  $\text{R}_3 = \text{H}$ , alkyl or aryl),  $\text{CR}_1(\text{OR}_2)_2$   $\text{CR}_q(\text{OR}_p)_2$  (where  $\text{R}_1, \text{R}_q = \text{H}$  or alkyl;  $\text{R}_2, \text{R}_p = \text{alkyl}$ ),  $\text{CF}_3$ ,  $\text{CF}_2\text{CF}_3$ , OTf, OTs,  $\text{OCOR}_v$  (where  $\text{R}_v = \text{H}$ , alkyl or aryl), and  $\text{OSiR}_w\text{R}_x\text{R}_y$  (where  $\text{R}_1, \text{R}_2, \text{R}_3, \text{R}_w, \text{R}_x$  or  $\text{R}_y = \text{alkyl or aryl}$ ).

16. (Currently Amended) The method of claim 12 wherein said epoxidation reaction is carried out in a homogeneous solvent system ~~containing~~ selected from

dimethoxymethane-acetonitrile-water, acetonitrile-water, acetone-water, dioxane-water, dimethoxyethane-water, and tetrahydrofuran-water, or a biphasic solvent system ~~containing~~ selected from dichloromethane-water, chloroform-water, benzene-water, toluene-water, dimethoxymethane-water, or diethylether-water, or mixtures thereof.

17. (Original) The method of claim 12 wherein said oxidizing reagent is selected from the group consisting of potassium peroxomonosulfate, sodium hypochlorite, sodium perborate, hydrogen peroxide, and peracids.

 18. (Original) The method of claim 17 wherein said epoxidation reaction is carried out using potassium peroxomonosulfate as an oxidizing agent.

19. (Original) The method of claim 12 wherein said epoxidation reaction is carried out at a temperature within the range from about -10 °C to about 40 °C.

20. (Original) The method of claim 19 wherein said epoxidation reaction is carried out at room temperature.

21. (Original) The method of claim 12 wherein said epoxidation reaction is carried out at a pH within the range from about 7.0 to about 12.0.

22. (Original) The method of claim 21 wherein said pH is within the range from about 7.0 to about 7.5.

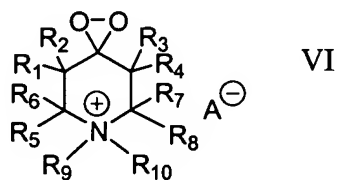
23. (Original) The method of claim 21 wherein said pH is controlled by using a pH-stat or a buffer.

24. (Currently Amended) The method of claim 23 wherein said buffer is selected from the ~~solutions~~group consisting of solutions of sodium bicarbonate, sodium carbonate, sodium borate, sodium hydrogenphosphate, sodium dihydrogenphosphate, sodium hydroxide, potassium hydrogenphosphate, potassium dihydrogenphosphate, potassium bicarbonate, ~~and~~ potassium carbonate, potassium hydroxide, and mixtures thereof.

25. (Original) The method of claim 12 wherein said epoxidation reaction provides said epoxides in at least about 5:1  $\beta/\alpha$ -epoxide ratio.

26. (Currently Amended) A method of producing mostly  $5\beta,6\beta$ -epoxides of steroids from  $\Delta^5$ -unsaturated steroids by an epoxidation reaction using a dioxirane under conditions effective to generate epoxides,

wherein said dioxirane is selected from compounds of generic formula VI,



$R_1$  or  $R_4$  in formula (VI) is selected from alkyl, halogenated alkyl, aryl,  ~~$\Theta R$~~  $\underline{OR}_{\underline{Y}}$  (where  $\underline{RR}_{\underline{Y}} = \text{H, alkyl or aryl}$ ),  ~~$\Theta C$~~  $\underline{OCOR}_{\underline{Y}}$  (where  $\underline{RR}_{\underline{Y}} = \text{H, alkyl or aryl}$ ),  ~~$\Theta C$~~  $\underline{OOROCOR}_{\underline{Y}}$  (where  $\underline{RR}_{\underline{Y}} = \text{alkyl or aryl}$ ),  $\text{OCOOCH}_2\underline{RR}_{\underline{Z}}$  (where  $\underline{RR}_{\underline{Z}} = \text{aryl}$ ),  ~~$\Theta C$~~  $\underline{ONR}_{\underline{U}}\underline{R}_{\underline{V}}$  (where  $\underline{R}_{\underline{U}}$  or  $\underline{R}_{\underline{V}} = \text{H, alkyl or aryl}$ ),  ~~$\Theta Si$~~  $\underline{R}_{\underline{U}}\underline{R}_{\underline{V}}\underline{OSiR}_{\underline{W}}\underline{R}_{\underline{X}}\underline{R}_{\underline{Y}}$  (where  $\underline{R}_{\underline{U}}, \underline{R}_{\underline{W}}, \underline{R}_{\underline{X}}$  or  $\underline{R}_{\underline{V}} = \text{alkyl or aryl}$ ), and halogen;

$R_2$  or  $R_3$  in formula (VI) is selected from H, alkyl, halogenated alkyl, aryl,  ~~$\Theta R$~~  $\underline{OR}_{\underline{Y}}$  (where  $\underline{RR}_{\underline{Y}} = \text{H, alkyl or aryl}$ ),  ~~$\Theta C$~~  $\underline{OCOR}_{\underline{Y}}$  (where  $\underline{RR}_{\underline{Y}} = \text{H, alkyl or aryl}$ ),



$\text{OCOROCOOR}_y$  (where  $\text{RR}_y$  = alkyl or aryl),  $\text{OCOOCH}_2\text{RR}_z$  (where  $\text{RR}_z$  = aryl),  
 $\text{CONR}_1\text{R}_2\text{CONR}_u\text{R}_v$  (where  $\text{R}_1\text{R}_u$  or  $\text{R}_2\text{R}_v$  = H, alkyl or aryl),  $\text{OSiR}_1\text{R}_2\text{R}_3\text{OSiR}_w\text{R}_x\text{R}_y$   
 (where  $\text{R}_1\text{R}_w$ ,  $\text{R}_2\text{R}_x$  or  $\text{R}_3\text{R}_y$  = alkyl or aryl), and halogen;

$\text{R}_5$ ,  $\text{R}_6$ ,  $\text{R}_7$  or  $\text{R}_8$  in formula (VI) is selected from H, alkyl, halogenated alkyl, aryl,  
 $\text{COORCOOR}_y$  (where  $\text{RR}_y$  = H, alkyl or aryl), and  $\text{CONR}_1\text{R}_2\text{CONR}_u\text{R}_v$  (where  $\text{R}_1\text{R}_u$  or  
 $\text{R}_2\text{R}_v$  = H, alkyl or aryl);

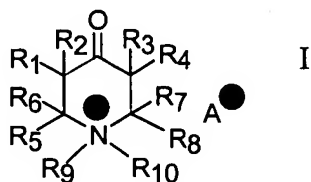
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$\text{R}_9$  or  $\text{R}_{10}$  in formula (VI) is selected from alkyl, halogenated alkyl, and aryl; and

A in formula (VI) is selected from halogen, OTf,  $\text{BF}_4$ , OAc,  $\text{NO}_3$ , BPh<sub>4</sub>,  $\text{PF}_6$ , and  
 $\text{SbF}_6$ .

27. (Currently Amended) The method of claim 26 wherein said dioxirane is  
 generated in situ from a ketone and an oxidizing agent selected from potassium  
 peroxomonosulfate, sodium hypochlorite, sodium perborate, hydrogen peroxide, and  
 peracids;


wherein said ketone is selected from compounds of generic formula I,



$\text{R}_1$  or  $\text{R}_4$  in formula (I) is selected from alkyl, halogenated alkyl, aryl,  $\text{OROR}_y$   
 (where  $\text{RR}_y$  = H, alkyl or aryl),  $\text{OCOROCOR}_y$  (where  $\text{RR}_y$  = H, alkyl or aryl),  
 $\text{OCOROCOOR}_y$  (where  $\text{RR}_y$  = alkyl or aryl),  $\text{OCOOCH}_2\text{RR}_z$  (where  $\text{RR}_z$  = aryl),

$\text{OCONR}_1\text{R}_2\text{OCONR}_u\text{R}_v$  (where  $\text{R}_1\text{R}_u$  or  $\text{R}_2\text{R}_v = \text{H}$ , alkyl or aryl),  $\text{OSiR}_1\text{R}_2\text{R}_3\text{OSiR}_w\text{R}_x\text{R}_y$  (where  $\text{R}_1\text{R}_w$ ,  $\text{R}_2\text{R}_x$  or  $\text{R}_3\text{R}_y = \text{alkyl or aryl}$ ), and halogen;

$\text{R}_2$  or  $\text{R}_3$  in formula (I) is selected from H, alkyl, halogenated alkyl, aryl,  $\text{OROR}_v$  (where  $\text{RR}_v = \text{H}$ , alkyl or aryl),  $\text{OCOROCOR}_v$  (where  $\text{RR}_v = \text{H}$ , alkyl or aryl),  $\text{OCCOOROCOR}_v$  (where  $\text{RR}_v = \text{alkyl or aryl}$ ),  $\text{OCCOCH}_2\text{ROCCOCH}_2\text{R}$  (where  $\text{RR}_z = \text{aryl}$ ),  $\text{OCONR}_1\text{R}_2\text{OCONR}_u\text{R}_v$  (where  $\text{R}_1\text{R}_u$  or  $\text{R}_2\text{R}_v = \text{H}$ , alkyl or aryl),  $\text{OSiR}_1\text{R}_2\text{R}_3\text{OSiR}_w\text{R}_x\text{R}_y$  (where  $\text{R}_1\text{R}_w$ ,  $\text{R}_2\text{R}_x$  or  $\text{R}_3\text{R}_y = \text{alkyl or aryl}$ ), and halogen;

  $\text{R}_5$ ,  $\text{R}_6$ ,  $\text{R}_7$  or  $\text{R}_8$  in formula (I) is selected from H, alkyl, halogenated alkyl, aryl,  $\text{COORCOOR}_v$  (where  $\text{RR}_v = \text{H}$ , alkyl or aryl), and  $\text{CONR}_1\text{R}_2\text{CONR}_u\text{R}_v$  (where  $\text{R}_1\text{R}_u$  or  $\text{R}_2\text{R}_v = \text{H}$ , alkyl or aryl);

$\text{R}_9$  or  $\text{R}_{10}$  in formula (I) is selected from alkyl, halogenated alkyl, and aryl; and

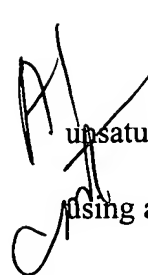
A in formula (I) is selected from halogen, OTf,  $\text{BF}_4$ , OAc,  $\text{NO}_3$ ,  $\text{BPh}_4$ ,  $\text{PF}_6$ , and  $\text{SbF}_6$ .

28. (Original) The method of claim 26 wherein said epoxidation reaction is carried out in a solvent selected from acetonitrile, dimethoxymethane, acetone, dioxane, dimethoxyethane, tetrahydrofuran, dichloromethane, chloroform, benzene, toluene, diethylether, water, and mixtures thereof.

29. (Original) The method of claim 26 wherein said epoxidation reaction is carried out at a temperature within the range from about  $-40^\circ\text{C}$  to about  $40^\circ\text{C}$ .

30. (Original) The method of claim 26 wherein said epoxidation reaction is carried out at a pH within the range from about 7.0 to about 12.0.

31. (Original) The method of claim 26 wherein said epoxidation reaction provides said epoxides in at least about 5:1  $\beta/\alpha$ -epoxide ratio.

 32. (Original) A method of producing mostly 5 $\beta$ ,6 $\beta$ -epoxides of steroids from  $\Delta^5$ -unsaturated steroids having a substituent at the 3 $\alpha$ -position by an epoxidation reaction using a dioxirane under conditions effective to generate epoxides.

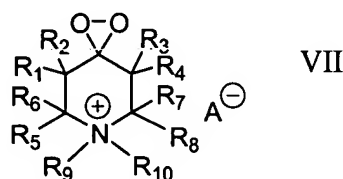
33. (Currently Amended) The method of claim 32 wherein said substituent is selected from  $OR_v$  (where  $R_v = H$ , alkyl or aryl),  $O(CH_2)_nOR_v$  (where  $n = 1, 2$  or  $3$ ,  $R_v = H$ , alkyl or aryl),  $O(CH_2)_mSO_nR_v$  (where  $n, m = 1, 2$  or  $3$ ;  $n = 0, 1$  or  $2$ ;  $R_v = H$ , alkyl or aryl),  $OSiR_1R_2R_3$ ,  $OSiR_wR_xR_y$  (where  $R_1, R_2$  or  $R_3$ ,  $R_w, R_x$  or  $R_y =$  alkyl or aryl),  $OSO_nR_v$  (where  $n = 0, 1$  or  $2$ ;  $R_v = H$ , alkyl or aryl),  $OCO_nR_v$  (where  $n = 1$  or  $2$ ;  $R_v = H$ , alkyl or aryl),  $OCONR_1R_2$ ,  $OCONR_uR_v$  (where  $R_1$  or  $R_2$ ,  $R_u$  or  $R_v = H$ , alkyl or aryl),  $OPO_nR_v$  (where  $n = 2$  or  $3$ ;  $R_v =$  alkyl or aryl),  $NR_1R_2$ ,  $NR_uR_v$  (where  $R_1$  or  $R_2$ ,  $R_u$  or  $R_v = H$ , alkyl or aryl),  $NR_1CO_nR_2$ ,  $NR_uCO_nR_v$  (where  $n = 1$  or  $2$ ;  $R_1$  or  $R_2$ ,  $R_u$  or  $R_v = H$ , alkyl or aryl),  $NR_1CONR_2R_3$ ,  $NR_uCONR_uR_v$  (where  $R_1, R_2$  or  $R_3$ ,  $R_u, R_u$  or  $R_v = H$ , alkyl or aryl),  $NR_1SO_nR_2$ ,  $NR_vSO_nR_v$  (where  $n = 1$  or  $2$ ;  $R_1, R_v = H$ , alkyl or aryl,  $R_2, R_v =$  alkyl or aryl),  $NPhth$  (Phth = phthaloyl group),  $^+NR_1R_2R_3$ ,  $^+NR_uR_uR_v$  (where  $R_1, R_2$  or  $R_3$ ,  $R_u, R_u$  or  $R_v = H$ , alkyl or aryl),  $SiR_1R_2R_3$ ,  $SiR_uR_uR_v$  (where  $R_1, R_2$  or  $R_3$ ,  $R_u, R_u$  or  $R_v = H$ , alkyl or aryl),  $SO_nR_v$  (where  $n = 0, 1$  or  $2$ ;  $R_v = H$ , alkyl or aryl),  $SCO_nR_v$  (where  $n = 1$  or  $2$ ;  $R_v = H$ , alkyl or aryl), halogen, CN,  $NO_2$ , alkyl, aryl,  $COOR_v$  (where  $R_v = H$ , alkyl or aryl), and  $CONR_1R_2$ ,  $CONR_uR_v$  (where  $R_1$  or  $R_2$ ,  $R_u$  or  $R_v = H$ , alkyl or aryl).

34. (Original) The method of claim 32 wherein said  $\Delta^5$ -unsaturated steroid having a substituent at the 3 $\alpha$ -position is selected from the group consisting of  $\Delta^5$ -unsaturated steroids having a ketal derivative of ketone group or a thioketal derivative of ketone group at the 3-position.

35. (Currently Amended) The method of claim 32 wherein said dioxirane is selected from the group consisting of compounds of generic formula VII, VIII, IX and X-,

wherein

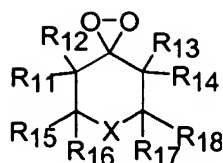
*Alt*  
*Chm*



$R_1$ ,  $R_2$ ,  $R_3$ , or  $R_4$  in formula (VII) is selected from H, alkyl, halogenated alkyl, aryl,  $\text{OROR}_v$  (where  $\text{RR}_v = \text{H}$ , alkyl or aryl),  $\text{OCOROCOR}_v$  (where  $\text{RR}_v = \text{H}$ , alkyl or aryl),  $\text{OCOROCOR}_v$  (where  $\text{RR}_v = \text{alkyl or aryl}$ ),  $\text{OCOOCH}_2\text{RR}_z$  (where  $\text{RR}_z = \text{aryl}$ ),  $\text{CONR}_1\text{R}_2\text{CONR}_u\text{R}_v$  (where  $\text{R}_1\text{R}_u$  or  $\text{R}_2\text{R}_v = \text{H}$ , alkyl or aryl),  $\text{OSiR}_1\text{R}_2\text{R}_3\text{OSiR}_w\text{R}_x\text{R}_y$  (where  $\text{R}_1\text{R}_w$ ,  $\text{R}_2\text{R}_x$  or  $\text{R}_3\text{R}_y = \text{alkyl or aryl}$ ), and halogen;

$R_5$ ,  $R_6$ ,  $R_7$ ,  $R_8$ ,  $R_9$  or  $R_{10}$ , in formula (VII) is selected from H, alkyl, halogenated alkyl, aryl,  $\text{COORCOOR}_v$  (where  $\text{RR}_v = \text{H}$ , alkyl or aryl), and  $\text{CONR}_1\text{R}_2\text{CONR}_u\text{R}_v$  (where  $\text{R}_1\text{R}_u$  or  $\text{R}_2\text{R}_v = \text{H}$ , alkyl or aryl);

A in formula (VII) is selected from halogen, OTf,  $\text{BF}_4$ , OAc,  $\text{NO}_3$ ,  $\text{BPh}_4$ ,  $\text{PF}_6$ , and  $\text{SbF}_6$ ;

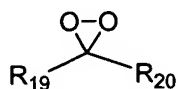


VIII

X in formula (VIII) is selected from  $(\text{CR}_1\text{R}_2\text{CR}_u\text{R}_v)_n$  (where  $n = 1, 2, 3, 4,$  or  $5$ ;  $\text{R}_1\text{R}_u$  or  $\text{R}_2\text{R}_v = \text{H},$  alkyl or aryl), O, S, SO, SO<sub>2</sub>, and  $\text{NR}_u\text{NR}_v$  (where  $\text{R}_u = \text{H},$  alkyl or aryl);

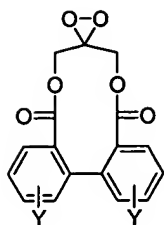
*Allyl*  
 $\text{R}_{11}, \text{R}_{12}, \text{R}_{13},$  or  $\text{R}_{14}$  in formula (VIII) is selected from H, alkyl, halogenated alkyl, aryl,  $\text{OROR}_v$  (where  $\text{R}_v = \text{H},$  alkyl or aryl),  $\text{OCOROCOR}_v$  (where  $\text{R}_v = \text{H},$  alkyl or aryl),  $\text{OCOOCH}_2\text{R}_z$  (where  $\text{R}_z = \text{H},$  alkyl or aryl),  $\text{OCOOCH}_2\text{R}_z$  (where  $\text{R}_z = \text{H},$  alkyl or aryl),  $\text{CONR}_1\text{R}_2\text{CONR}_u\text{R}_v$  (where  $\text{R}_1\text{R}_u$  or  $\text{R}_2\text{R}_v = \text{H},$  alkyl or aryl),  $\text{OSiR}_1\text{R}_2\text{OSiR}_w\text{R}_x\text{R}_y$  (where  $\text{R}_1\text{R}_w, \text{R}_2\text{R}_x$  or  $\text{R}_3\text{R}_y = \text{H},$  alkyl or aryl), and halogen;

$\text{R}_{15}, \text{R}_{16}, \text{R}_{17},$  or  $\text{R}_{18}$  in formula (VIII) is selected from H, alkyl, halogenated alkyl, aryl,  $\text{COORCOOR}_v$  (where  $\text{R}_v = \text{H},$  alkyl or aryl), and  $\text{CONR}_1\text{R}_2\text{CONR}_u\text{R}_v$  (where  $\text{R}_1\text{R}_u$  or  $\text{R}_2\text{R}_v = \text{H},$  alkyl or aryl);



IX

$\text{R}_{19}$  or  $\text{R}_{20}$  in formula (IX) is selected from alkyl, halogenated alkyl, aryl,  $\text{CR}_1\text{R}_2\text{OCOR}_3$ ,  $\text{CR}_1\text{R}_u\text{OCOR}_v$  (where  $\text{R}_1, \text{R}_2$  or  $\text{R}_3, \text{R}_u$  or  $\text{R}_v = \text{H},$  alkyl or aryl),  $\text{CR}_1\text{R}_2\text{OCOOCH}_2\text{R}_z$ ,  $\text{CR}_1\text{R}_u\text{OCOOCH}_2\text{R}_z$  (where  $\text{R}_1$  or  $\text{R}_2, \text{R}_u$  or  $\text{R}_v = \text{H},$  alkyl or aryl;  $\text{R}_3, \text{R}_z = \text{H},$  alkyl or aryl),  $\text{CR}_1\text{R}_2\text{NR}_3\text{COOR}_4$ ,  $\text{CR}_1\text{R}_u\text{NR}_v\text{COOR}_y$  (where  $\text{R}_1, \text{R}_2$  or  $\text{R}_3, \text{R}_u$  or  $\text{R}_v = \text{H},$  alkyl or aryl,  $\text{R}_4, \text{R}_y = \text{H},$  alkyl or aryl),  $\text{CR}_1\text{R}_2\text{NR}_3\text{COR}_4$ ,  $\text{CR}_1\text{R}_u\text{NR}_v\text{COR}_y$  (where  $\text{R}_1, \text{R}_2, \text{R}_3$  or  $\text{R}_4, \text{R}_u, \text{R}_v$  or  $\text{R}_y = \text{H},$  alkyl or aryl),  $\text{CR}_1\text{R}_2\text{NR}_3\text{SO}_2\text{R}_4$ ,  $\text{CR}_1\text{R}_u\text{NR}_v\text{SO}_2\text{R}_y$  (where  $\text{R}_1, \text{R}_2, \text{R}_3$  or  $\text{R}_4, \text{R}_u, \text{R}_v$  or  $\text{R}_y = \text{H},$  alkyl or aryl;  $\text{R}_4, \text{R}_y = \text{H},$  alkyl or aryl); and

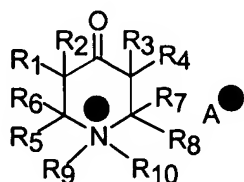


X

Y in formula (X) is selected from H, alkyl, halogenated alkyl, aryl, NO<sub>2</sub>, CN, F, Cl, Br, I, COOR<sub>q</sub> (where R<sub>q</sub> = H or alkyl), OR<sub>y</sub> (where R<sub>y</sub> = H, alkyl or aryl), OSO<sub>2</sub>R<sub>y</sub> (where R<sub>y</sub> = H, alkyl or aryl), OSOR<sub>y</sub> (where R<sub>y</sub> = H, alkyl or aryl), OSR<sub>y</sub> (where R<sub>y</sub> = H, alkyl or aryl), SO<sub>2</sub>R<sub>y</sub> (where R<sub>y</sub> = H, alkyl or aryl), SO<sub>3</sub>R<sub>y</sub> (where R<sub>y</sub> = H, alkyl or aryl), ~~NR<sub>1</sub>SOOR<sub>2</sub>NR<sub>y</sub>SOOR<sub>y</sub>~~ (where R<sub>1</sub>, R<sub>u</sub> or R<sub>2</sub>, R<sub>y</sub> = H, alkyl or aryl), ~~NR<sub>1</sub>SOOR<sub>2</sub>NR<sub>y</sub>SOOR<sub>y</sub>~~ (where R<sub>1</sub>, R<sub>y</sub> = H, alkyl or aryl; R<sub>2</sub>, R<sub>y</sub> = alkyl or aryl), ~~NR<sub>1</sub>SOOR<sub>2</sub>NR<sub>y</sub>SOOR<sub>y</sub>~~ (where R<sub>1</sub>, R<sub>y</sub> = H, alkyl or aryl; R<sub>2</sub>, R<sub>y</sub> = alkyl or aryl), ~~CR<sub>1</sub>R<sub>2</sub>OR<sub>3</sub>CR<sub>u</sub>R<sub>v</sub>OR<sub>y</sub>~~ (where R<sub>1</sub>, R<sub>2</sub> or R<sub>3</sub>, R<sub>u</sub> or R<sub>v</sub> = H, alkyl or aryl), ~~CR<sub>1</sub>(OR<sub>2</sub>)<sub>2</sub>CR<sub>u</sub>(OR<sub>v</sub>)<sub>2</sub>~~ (where R<sub>1</sub>, R<sub>u</sub> = H or alkyl; R<sub>2</sub>, R<sub>v</sub> = alkyl), CF<sub>3</sub>, CF<sub>2</sub>CF<sub>3</sub>, OTf, OTs, OCOR<sub>y</sub> (where R<sub>y</sub> = H, alkyl or aryl), and ~~OSiR<sub>1</sub>R<sub>2</sub>R<sub>3</sub>~~ OSiR<sub>x</sub>R<sub>y</sub>R<sub>z</sub> (where R<sub>1</sub>, R<sub>2</sub> or R<sub>3</sub>, R<sub>x</sub>, R<sub>y</sub> or R<sub>z</sub> = alkyl or aryl).

36. (Original) The method of claim 32 wherein said dioxirane is generated in situ from a ketone and an oxidizing agent selected from potassium peroxomonosulfate, sodium hypochlorite, sodium perborate, hydrogen peroxide, and peracids.

37. (Currently Amended) The method of claim 36 wherein said ketone is selected from the group consisting of compounds of generic formula II, III, IV, and V,

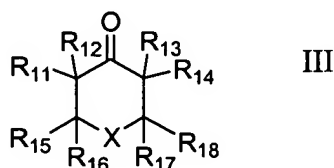


II

$R_1, R_2, R_3$ , or  $R_4$  in formula (II) is selected from H, alkyl, halogenated alkyl, aryl,  $\text{OROR}_v$  (where  $\text{RR}_v = \text{H}$ , alkyl or aryl),  $\text{OCOROCOR}_v$  (where  $\text{RR}_v = \text{H}$ , alkyl or aryl),  $\text{OCOROCOR}_v$  (where  $\text{RR}_v = \text{alkyl}$  or aryl),  $\text{OCOOCH}_2\text{RR}_z$  (where  $\text{RR}_z = \text{aryl}$ ),  $\text{CONR}_1\text{R}_2\text{CONR}_u\text{R}_v$  (where  $\text{R}_1\text{R}_u$  or  $\text{R}_2\text{R}_v = \text{H}$ , alkyl or aryl),  $\text{OSiR}_1\text{R}_2\text{R}_3\text{OSiR}_w\text{R}_x\text{R}_y$  (where  $\text{R}_1\text{R}_w$ ,  $\text{R}_2\text{R}_x$  or  $\text{R}_3\text{R}_y = \text{alkyl}$  or aryl), and halogen;

$R_5, R_6, R_7, R_8, R_9$  or  $R_{10}$  in formula (II) is selected from H, alkyl, halogenated alkyl, aryl,  $\text{COORCOOR}_v$  (where  $\text{RR}_v = \text{H}$ , alkyl or aryl), and  $\text{CONR}_1\text{R}_2\text{CONR}_u\text{R}_v$  (where  $\text{R}_1\text{R}_u$  or  $\text{R}_2\text{R}_v = \text{H}$ , alkyl or aryl);

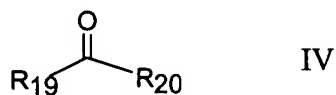
A in formula (II) is selected from halogen, OTf,  $\text{BF}_4$ , OAc,  $\text{NO}_3$ ,  $\text{BPh}_4$ ,  $\text{PF}_6$ , and  $\text{SbF}_6$ ;



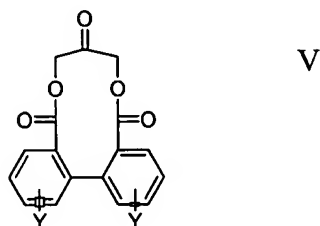
X in formula (III) is selected from  $(\text{CR}_1\text{R}_2\text{CR}_u\text{R}_v)_n$  (where  $n = 1, 2, 3, 4$ , or  $5$ ;  $\text{R}_1\text{R}_u$  or  $\text{R}_2\text{R}_v = \text{H}$ , alkyl or aryl), O, S, SO,  $\text{SO}_2$ , and  $\text{NRNR}_v$  (where  $\text{RR}_v = \text{H}$ , alkyl or aryl);

$R_{11}, R_{12}, R_{13}$ , or  $R_{14}$  in formula (III) is selected from H, alkyl, halogenated alkyl, aryl,  $\text{OROR}_v$  (where  $\text{RR}_v = \text{H}$ , alkyl or aryl),  $\text{OCOROCOR}_v$  (where  $\text{RR}_v = \text{H}$ , alkyl or aryl),  $\text{OCOROCOR}_v$  (where  $\text{RR}_v = \text{alkyl}$  or aryl),  $\text{OCOOCH}_2\text{RR}_z$  (where  $\text{RR}_z = \text{aryl}$ ),  $\text{CONR}_1\text{R}_2\text{CONR}_u\text{R}_v$  (where  $\text{R}_1\text{R}_u$  or  $\text{R}_2\text{R}_v = \text{H}$ , alkyl or aryl),  $\text{OSiR}_1\text{R}_2\text{R}_3\text{OSiR}_w\text{R}_x\text{R}_y$  (where  $\text{R}_1\text{R}_w$ ,  $\text{R}_2\text{R}_x$  or  $\text{R}_3\text{R}_y = \text{alkyl}$  or aryl), and halogen;

$R_{15}$ ,  $R_{16}$ ,  $R_{17}$ , or  $R_{18}$  in formula (III) is selected from H, alkyl, halogenated alkyl, aryl,  $\text{COORCOOR}_v$  (where  $\text{RR}_v = \text{H}$ , alkyl or aryl), and  $\text{CONR}_1\text{R}_2\text{CONR}_u\text{R}_v$  (where  $\text{R}_1\text{R}_u$  or  $\text{R}_2\text{R}_v = \text{H}$ , alkyl or aryl);



$R_{19}$  or  $R_{20}$  in formula (IV) is selected from alkyl, halogenated alkyl, aryl,  $\text{CR}_1\text{R}_2\text{OCOR}_3$ ,  $\text{CR}_1\text{R}_u\text{OCOR}_v$  (where  $\text{R}_1$ ,  $\text{R}_2$  or  $\text{R}_3$ ,  $\text{R}_1$ ,  $\text{R}_u$  or  $\text{R}_v = \text{H}$ , alkyl or aryl),  $\text{CR}_1\text{R}_2\text{OCOO}\text{R}_3$ ,  $\text{CR}_u\text{R}_v\text{OCOO}\text{R}_v$  (where  $\text{R}_1$ ,  $\text{R}_u$  or  $\text{R}_2$ ,  $\text{R}_v = \text{H}$ , alkyl or aryl;  $\text{R}_3$ ,  $\text{R}_v = \text{alkyl}$  or aryl),  $\text{CR}_1\text{R}_2\text{NR}_3\text{COOR}_4$ ,  $\text{CR}_1\text{R}_u\text{NR}_v\text{COOR}_v$  (where  $\text{R}_1$ ,  $\text{R}_2$  or  $\text{R}_3$ ,  $\text{R}_1$ ,  $\text{R}_u$  or  $\text{R}_v = \text{H}$ , alkyl or aryl,  $\text{R}_4$ ,  $\text{R}_v = \text{alkyl}$  or aryl),  $\text{CR}_1\text{R}_2\text{NR}_3\text{COR}_4$ ,  $\text{CR}_1\text{R}_u\text{NR}_v\text{COR}_v$  (where  $\text{R}_1$ ,  $\text{R}_2$ ,  $\text{R}_3$  or  $\text{R}_4$ ,  $\text{R}_5$ ,  $\text{R}_1$ ,  $\text{R}_u$  or  $\text{R}_v = \text{H}$ , alkyl or aryl),  $\text{CR}_1\text{R}_2\text{NR}_3\text{SO}_2\text{R}_4$ ,  $\text{CR}_1\text{R}_u\text{NR}_v\text{SO}_2\text{R}_v$  (where  $\text{R}_1$ ,  $\text{R}_2$  or  $\text{R}_3$ ,  $\text{R}_1$ ,  $\text{R}_u$  or  $\text{R}_v = \text{H}$ , alkyl or aryl;  $\text{R}_4$ ,  $\text{R}_v = \text{alkyl}$  or aryl); and



$Y$  in formula (V) is selected from H, alkyl, halogenated alkyl, aryl,  $\text{NO}_2$ ,  $\text{CN}$ ,  $\text{F}$ ,  $\text{Cl}$ ,  $\text{Br}$ ,  $\text{I}$ ,  $\text{COORCOOR}_q$  (where  $\text{RR}_q = \text{H}$  or alkyl),  $\text{OROR}_v$  (where  $\text{RR}_v = \text{H}$ , alkyl or aryl),  $\text{OSO}_2\text{RR}_v$  (where  $\text{RR}_v = \text{H}$ , alkyl or aryl),  $\text{OSOROSOR}_v$  (where  $\text{RR}_v = \text{H}$ , alkyl or aryl),  $\text{OSROSOR}_v$  (where  $\text{RR}_v = \text{H}$ , alkyl or aryl),  $\text{SO}_2\text{RR}_v$  (where  $\text{RR}_v = \text{H}$ , alkyl or aryl),  $\text{SO}_3\text{RR}_v$  (where  $\text{RR}_v = \text{H}$ , alkyl or aryl),  $\text{SOONR}_1\text{R}_2\text{R}_u\text{R}_v$  (where  $\text{R}_1$  or  $\text{R}_2$ ,  $\text{R}_u$  or  $\text{R}_v = \text{H}$ , alkyl or aryl),  $\text{NR}_1\text{SOOR}_2\text{NR}_v\text{SOOR}_v$  (where  $\text{R}_1$ ,  $\text{R}_v = \text{H}$ , alkyl or aryl;  $\text{R}_2$ ,  $\text{R}_v = \text{alkyl}$  or aryl),  $\text{NR}_1\text{SOR}_2\text{NR}_v\text{SOR}_v$  (where  $\text{R}_1$ ,  $\text{R}_v = \text{H}$ , alkyl or aryl;  $\text{R}_2$ ,  $\text{R}_v = \text{alkyl}$  or aryl),



$\text{CR}_1\text{R}_2\text{OR}_3$ ,  $\text{CR}_1\text{R}_2\text{OR}_3$  (where  $\text{R}_1, \text{R}_2$  or  $\text{R}_3$ ,  $\text{R}_1, \text{R}_2$  or  $\text{R}_3$  = H, alkyl or aryl),  $\text{CR}_1(\text{OR}_2)_2$ ,  $\text{CR}_1(\text{OR}_2)_2$  (where  $\text{R}_1, \text{R}_2$  = H or alkyl;  $\text{R}_2, \text{R}_3$  = alkyl),  $\text{CF}_3$ ,  $\text{CF}_2\text{CF}_3$ , OTf, OTs,  $\text{OCOR}_y$  (where  $\text{R}_y$  = H, alkyl or aryl), and  $\text{OSiR}_1\text{R}_2\text{R}_3$ ,  $\text{OSiR}_w\text{R}_x\text{R}_y$  (where  $\text{R}_1, \text{R}_2$  or  $\text{R}_3$ ,  $\text{R}_w, \text{R}_x$  or  $\text{R}_y$  = alkyl or aryl).

38. (Original) The method of claim 32 wherein said epoxidation reaction is carried out in a solvent selected from acetonitrile, dimethoxymethane, acetone, dioxane, dimethoxyethane, tetrahydrofuran, dichloromethane, chloroform, benzene, toluene, diethylether, water and mixtures thereof.

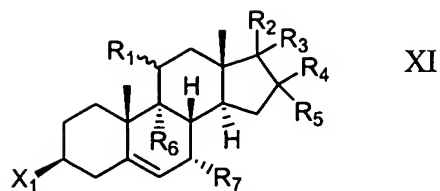
39. (Original) The method of claim 32 wherein said epoxidation reaction is carried out at a temperature within the range from about  $-40^\circ\text{C}$  to about  $40^\circ\text{C}$ .

40. (Original) The method of claim 32 wherein said epoxidation reaction is carried out at a pH within the range from about 7.0 to about 12.0.

41. (Original) The method of claim 32 wherein said epoxidation reaction provides said epoxides in at least about 5:1  $\beta/\alpha$ -epoxide ratio.

42. (Currently Amended) A method comprising:

producing mostly  $5\beta,6\beta$ -epoxides of steroids by epoxidation reactions of  $\Delta^5$ -unsaturated steroids of generic formula XI catalyzed by ketones of generic formula XII, wherein



$X_1$  in formula (XI) is selected from H,  $\Theta R \underline{OR}_q$  (where  $\underline{RR}_q$  = H or alkyl),  $OCH_2OCH_3$ ,  $\Theta C \underline{OR} \underline{OCOR}_y$  (where  $\underline{RR}_y$  = alkyl or aryl),  $\Theta Si \underline{R}_w \underline{OSiR}_w' \underline{R}_x \underline{R}_y'$  (where  $\underline{R}_w \underline{R}_w'$ ,  $\underline{R}_x \underline{R}_x'$  or  $\underline{R}_y \underline{R}_y'$  = alkyl or aryl), halogen, CN, alkyl, aryl, and  $\Theta \underline{OR} \underline{COOR}_y$  (where  $\underline{RR}_y$  = H, alkyl or aryl);

$R_1$  in formula (XI) is selected from H,  $\Theta R \underline{OR}_q$  (where  $\underline{RR}_q$  = H or alkyl),  $\Theta C \underline{OR} \underline{OCOR}_y$  (where  $\underline{RR}_y$  = alkyl or aryl),  $OCH_2OCH_3$ , halogen,  $CF_3$ , and  $CF_2CF_3$ ;

$R_2$  and  $R_3$  in formula (XI) are each selected from the group consisting of H, alkyl, aryl, halogen,  $\Theta R \underline{OR}_q$  (where  $\underline{RR}_q$  = H or alkyl),  $\Theta C \underline{OR} \underline{OCOR}_y$  (where  $\underline{RR}_y$  = alkyl or aryl),  $\Theta Si \underline{R}_w \underline{OSiR}_w' \underline{R}_x \underline{R}_y'$  (where  $\underline{R}_w \underline{R}_w'$ ,  $\underline{R}_x \underline{R}_x'$  or  $\underline{R}_y \underline{R}_y'$  = alkyl or aryl),  $\Theta \underline{OR} \underline{COR}_p$  (where  $\underline{RR}_p$  = alkyl),  $COCH_2 \Theta R \underline{OR}_q$  (where  $\underline{RR}_q$  = H or alkyl),  $COCH_2 \Theta C \underline{OR} \underline{OCOR}_y$  (where  $\underline{RR}_y$  = alkyl or aryl),  $COCH_2F$ ,  $\Theta \underline{OR} \underline{COOR}_q$  (where  $\underline{RR}_q$  = H or alkyl),  $C(OCH_2CH_2O) \underline{RR}_p$  (where  $\underline{RR}_p$  = alkyl),  $C(OCH_2CH_2O)CH_2 \Theta R \underline{OR}_q$  (where  $\underline{RR}_q$  = H or alkyl),  $C(OCH_2CH_2O)CH_2 \Theta C \underline{OR} \underline{OCOR}_y$  (where  $\underline{RR}_y$  = alkyl or aryl), and  $C(OCH_2CH_2O)CH_2F$ ; or, are selected from the group consisting of O,  $OCH_2CH_2O$ , and  $OCH_2CH_2CH_2O$ ;

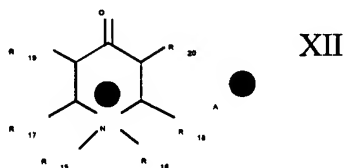
$R_4$  in formula (XI) is selected from H,  $C_1-C_4$  alkyl, halogen,  $\Theta R \underline{OR}_q$  (where  $\underline{RR}_q$  = H or alkyl),  $\Theta C \underline{OR} \underline{OCOR}_y$  (where  $\underline{RR}_y$  = alkyl or aryl), and  $\Theta Si \underline{R}_w \underline{OSiR}_w' \underline{R}_x \underline{R}_y'$  (where  $\underline{R}_w \underline{R}_w'$ ,  $\underline{R}_x \underline{R}_x'$  or  $\underline{R}_y \underline{R}_y'$  = alkyl or aryl);

$R_5$  in formula (XI) is selected from H,  $C_1$ – $C_4$  alkyl, halogen,  $\Theta ROR_q$  (where  $RR_q$  = H or alkyl),  $\Theta C(OR)OCOR_y$  (where  $RR_y$  = alkyl or aryl), and  $\Theta SiR_wOSiR'_wR'_xR'_y$  (where  $R_wR'_w$ ,  $R_xR'_x$  or  $R_yR'_y$  = alkyl or aryl);

$R_6$  in formula (XI) is selected from H, halogen,  $\Theta ROR_q$  (where  $R_q$  = H or alkyl), and  $\Theta C(OR)OCOR_y$  (where  $RR_y$  = alkyl or aryl);

$R_7$  in formula (XI) is selected from H, halogen,  $\Theta ROR_q$  (where  $RR_q$  = H or alkyl), and  $\Theta C(OR)OCOR_y$  (where  $RR_y$  = alkyl or aryl);

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$R_{15}$  and  $R_{16}$  in formula (XII) are each selected from alkyl and aryl;

$R_{17}$  and  $R_{18}$  in formula (XII) are each selected from H, alkyl, aryl,  $\Theta C(OR)COOR_y$  (where  $RR_y$  = H, alkyl or aryl), and  $\Theta CONR_uR_vCONR_uR_v$  (where  $R_uR_u$  or  $R_vR_v$  = H, alkyl or aryl);

$R_{19}$  and  $R_{20}$  in formula (XII) are each selected from  $C_1$ – $C_4$  alkyl, halogenated alkyl, and halogen; and

A in formula (XII) is selected from OTf,  $BF_4$ , OAc,  $NO_3$ ,  $BPh_4$ ,  $PF_6$ , and  $SbF_6$ .

43. (Currently Amended) The method of claim 42 wherein said  $C_1$ – $C_4$  alkyl is selected from the group consisting of methyl, ethyl, normal-propyl, iso-propyl, normal-

butyl, iso-butyl, sec-butyl, and tert-butyl; and said aryl is selected from the group consisting of phenyl, substituted phenyl, naphthyl, and substituted naphthyl groups.

44. (Original) The method of claim 42 wherein said epoxidation reactions are carried out in a homogeneous solvent system selected from the group consisting of dimethoxymethane-acetonitrile-water, acetonitrile-water, acetone-water, dioxane-water, dimethoxyethane-water, tetrahydrofuran-water, and mixtures thereof.

45. (Currently Amended) The method of claim 42 wherein said epoxidation reactions are carried out in a biphasic solvent system selected from the group consisting of dichloromethane-water, chloroform-water, benzene-water, toluene-water, dimethoxymethane-water, ~~or~~ and diethylether-water, and mixtures thereof.

46. (Original) The method of claim 42 wherein said oxidizing reagent is selected from the group consisting of potassium peroxomonosulfate, sodium hypochlorite, sodium perborate, hydrogen peroxide, and peracids.

47. (Original) The method of claim 42 wherein said epoxidation reactions are carried out at a temperature within the range from about -10 °C to about 40 °C.

48. (Original) The method of claim 47 wherein said epoxidation reactions are carried out at room temperature.

49. (Original) The method of claim 42 wherein said epoxidation reactions are carried out at a pH within the range from about 7.0 to about 12.0.

50. (Original) The method of claim 49 wherein said pH is within the range from 7.0 to 7.5.

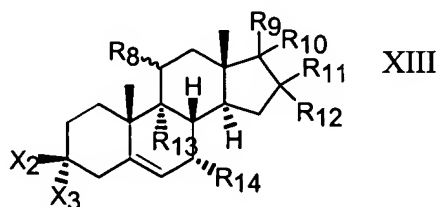
51. (Original) The method of claim 49 wherein said pH is controlled by using a pH-stat or a buffer.

52. (Currently Amended) The method of claim 51 wherein said buffer is selected from the group consisting of sodium bicarbonate, sodium carbonate, sodium borate, sodium hydrogenphosphate, sodium dihydrogenphosphate, sodium hydroxide, potassium hydrogenphosphate, potassium dihydrogenphosphate, potassium bicarbonate, potassium carbonate, potassium hydroxide, ~~or~~ and mixtures thereof.

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53. (Currently Amended) A method comprising:

producing mostly 5 $\beta$ ,6 $\beta$ -epoxides of steroids by epoxidation reactions of  $\Delta^5$ -unsaturated steroids of generic formula XIII catalyzed by ketones of generic formula XIV, XV, XVI, and XVII, wherein



X<sub>2</sub> in formula (XIII) is selected from the group consisting of H, ~~OR~~OR<sub>q</sub> (where RR<sub>q</sub> = H or alkyl), OCH<sub>2</sub>OCH<sub>3</sub>, ~~OCOR~~OCOR<sub>y</sub> (where RR<sub>y</sub> = alkyl or aryl), ~~OSiR<sub>4</sub>~~OSiR<sub>w</sub>'R<sub>2</sub>R<sub>x</sub>'R<sub>3</sub>R<sub>y</sub>' (where R<sub>1</sub>R<sub>w</sub>', R<sub>2</sub>R<sub>x</sub>' or R<sub>3</sub>R<sub>y</sub>' = alkyl or aryl), halogen, CN, alkyl, aryl, and ~~COOR~~COOR<sub>v</sub> (where RR<sub>v</sub> = H, alkyl or aryl), and,

X<sub>3</sub> in formula (XIII) is selected from the group consisting of  $\Theta R \underline{OR}_q$  (where  $\underline{RR}_q$  = H or alkyl),  $OCH_2OCH_3$ ,  $\Theta C \underline{OROCOR}_y$  (where  $\underline{RR}_y$  = alkyl or aryl),  $\Theta Si \underline{R}_1 \underline{OSiR}_w' \underline{R}_2 \underline{R}_x' \underline{R}_3 \underline{R}_y'$  (where  $\underline{R}_1 \underline{R}_w'$ ,  $\underline{R}_2 \underline{R}_x'$  or  $\underline{R}_3 \underline{R}_y'$  = alkyl or aryl), halogen, CN, NO<sub>2</sub>, alkyl, and aryl; or,

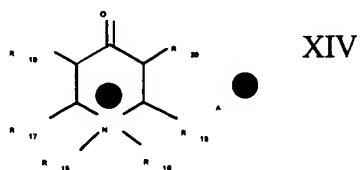
X<sub>2</sub> and X<sub>3</sub> in formula (XIII) are selected from the group consisting of O,  $OCH_2CH_2O$ , and  $OCH_2CH_2CH_2O$ ;

R<sub>8</sub> in formula (XIII) is selected from H,  $\Theta R \underline{OR}_q$  (where  $\underline{RR}_q$  = H or alkyl),  $\Theta C \underline{OROCOR}_y$  (where  $\underline{RR}_y$  = alkyl or aryl),  $OCH_2OCH_3$ , halogen, CF<sub>3</sub>, and CF<sub>2</sub>CF<sub>3</sub>;

R<sub>9</sub> and R<sub>10</sub> in formula (XIII) are each selected from the group consisting of H, alkyl, aryl, halogen,  $\Theta R \underline{OR}_q$  (where  $\underline{RR}_q$  = H or alkyl),  $\Theta C \underline{OROCOR}_y$  (where  $\underline{RR}_y$  = alkyl or aryl),  $\Theta Si \underline{R}_1 \underline{OSiR}_w' \underline{R}_2 \underline{R}_x' \underline{R}_3 \underline{R}_y'$  (where  $\underline{R}_1 \underline{R}_w'$ ,  $\underline{R}_2 \underline{R}_x'$  or  $\underline{R}_3 \underline{R}_y'$  = alkyl or aryl),  $\Theta C \underline{ORCOR}_p$  (where  $\underline{RR}_p$  = alkyl),  $COCH_2 \Theta R \underline{OR}_q$  (where  $\underline{RR}_q$  = H or alkyl),  $COCH_2 \Theta C \underline{OROCOR}_y$  (where  $\underline{RR}_y$  = alkyl or aryl),  $COCH_2F$ ,  $\Theta C \underline{ORCOOR}_q$  (where  $\underline{RR}_q$  = H or alkyl),  $C(OCH_2CH_2O) \underline{RR}_p$  (where  $\underline{RR}_p$  = alkyl),  $C(OCH_2CH_2O)CH_2 \Theta R \underline{OR}_q$  (where  $\underline{RR}_q$  = H or alkyl),  $C(OCH_2CH_2O)CH_2 \Theta C \underline{OROCOR}_y$  (where  $\underline{RR}_y$  = alkyl or aryl), and  $C(OCH_2CH_2O)CH_2F$ ; or R<sub>9</sub> and R<sub>10</sub> in formula (XIII) are selected from the group consisting of O,  $OCH_2CH_2O$ , and  $OCH_2CH_2CH_2O$ ;

R<sub>11</sub> and R<sub>12</sub> in formula (XIII) are each selected from the group consisting of H, C<sub>1</sub>–C<sub>4</sub> alkyl, halogen,  $\Theta R \underline{OR}_q$  (where  $\underline{RR}_q$  = H or alkyl),  $\Theta C \underline{OROCOR}_y$  (where  $\underline{RR}_y$  = alkyl or aryl), and  $\Theta Si \underline{R}_1 \underline{OSiR}_w' \underline{R}_2 \underline{R}_x' \underline{R}_3 \underline{R}_y'$  (where  $\underline{R}_1 \underline{R}_w'$ ,  $\underline{R}_2 \underline{R}_x'$  or  $\underline{R}_3 \underline{R}_y'$  = alkyl or aryl);

$R_{13}$  and  $R_{14}$  in formula (XIII) are each selected from the group consisting of H, halogen,  $\text{OROR}_q$  (where  $\text{RR}_q = \text{H}$  or alkyl), and  $\text{OCOROCOR}_y$  (where  $\text{RR}_y = \text{alkyl}$  or aryl);

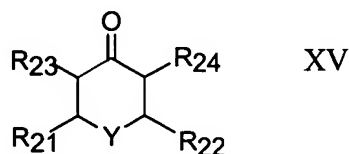


$R_{15}$  or  $R_{16}$  in formula (XIV) is selected from alkyl and aryl;

$R_{17}$  or  $R_{18}$  in formula (XIV) is selected from H, alkyl, aryl,  $\text{COORCOOR}_y$  (where  $\text{RR}_y = \text{H}$ , alkyl or aryl), and  $\text{CONR}_u\text{CONR}_v$  (where  $\text{R}_u\text{R}_v$  or  $\text{R}_2\text{R}_v = \text{H}$ , alkyl or aryl);

$R_{19}$  or  $R_{20}$  in formula (XIV) is selected from H,  $\text{C}_1\text{--C}_4$  alkyl, halogenated alkyl, and halogen; and

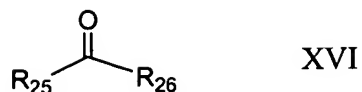
A in formula (XIV) is selected from OTf,  $\text{BF}_4$ , OAc,  $\text{NO}_3$ ,  $\text{BPh}_4$ ,  $\text{PF}_6$ , and  $\text{SbF}_6$ ;



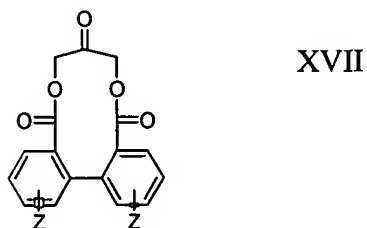
Y in formula (XV) is selected from  $\text{CH}_2$ , O, S, SO,  $\text{SO}_2$ , and  $\text{NRNR}_q$  (where  $\text{RR}_q = \text{H}$  or alkyl);

$R_{21}$  or  $R_{22}$  in formula (XV) is selected from H, alkyl, aryl,  $\text{COORCOOR}_y$  (where  $\text{RR}_y = \text{H}$ , alkyl or aryl), and  $\text{CONR}_u\text{CONR}_v$  (where  $\text{R}_u\text{R}_v$  or  $\text{R}_2\text{R}_v = \text{H}$ , alkyl or aryl);

$R_{23}$  or  $R_{24}$  in formula (XV) is selected from H, halogen,  $\text{C}_1\text{--C}_4$  alkyl, halogenated alkyl, and  $\text{OCOROCOR}_y$  (where  $\text{RR}_y = \text{alkyl}$  or aryl);



$\text{R}_{25}$  or  $\text{R}_{26}$  in formula (XVI) is selected from  $\text{C}_1\text{--C}_4$  alkyl, halogenated alkyl,  $\text{CH}_2\text{OCOROCOR}_y$  (where  $\text{R}_y$  = alkyl or aryl); and



*AK*  
*cm*

$\text{Z}$  in formula (XVII) is selected from  $\text{H}$ ,  $\text{C}_1\text{--C}_4$  alkyl, aryl,  $\text{NO}_2$ ,  $\text{CN}$ ,  $\text{F}$ ,  $\text{Cl}$ ,  $\text{Br}$ ,  $\text{I}$ ,  $\text{COORCOOR}_p$  (where  $\text{R}_p$  = alkyl),  $\text{CH}_2\text{OROR}_q$  (where  $\text{R}_q$  =  $\text{H}$  or alkyl),  $\text{CH}(\text{OROR}_p)_2$  (where  $\text{R}_p$  = alkyl),  $\text{CF}_3$ ,  $\text{CF}_2\text{CF}_3$ ,  $\text{OTf}$ ,  $\text{OTs}$ ,  $\text{OCOROCOR}_y$  (where  $\text{R}_y$  = alkyl or aryl), and  $\text{OSiR}_w\text{R}_x\text{R}_y$  (where  $\text{R}_w$ ,  $\text{R}_x$  or  $\text{R}_y$  = alkyl or aryl).

54. (Currently Amended) The method of claim 53 wherein said  $\text{C}_1\text{--C}_4$  alkyl is selected from the group consisting of methyl, ethyl, normal-propyl, iso-propyl, normal-butyl, iso-butyl, sec-butyl, and tert-butyl; and said aryl is selected from the group consisting of phenyl, substituted phenyl, naphthyl, and substituted naphthyl groups.

55. (Original) The method of claim 53 wherein said epoxidation reactions are carried out in a homogeneous solvent system selected from the group consisting of dimethoxymethane-acetonitrile-water, acetonitrile-water, acetone-water, dioxane-water, dimethoxyethane-water, and tetrahydrofuran-water, and mixtures thereof.

56. (Currently Amended) The method of claim 53 wherein said epoxidation reactions are carried out in a biphasic solvent system selected from the group consisting



of dichloromethane-water, chloroform-water, benzene-water, toluene-water, dimethoxymethane-water, ~~or~~and diethylether-water, and mixtures thereof.

57. (Original) The method of claim 53 wherein said oxidizing reagent is selected from the group consisting of potassium peroxomonosulfate, sodium hypochlorite, sodium perborate, hydrogen peroxide, and peracids.

58. (Original) The method of claim 53 wherein said epoxidation reactions are carried out at a temperature within the range from about -10 °C to about 40 °C.

59. (Original) The method of claim 58 wherein said epoxidation reactions are carried out at room temperature.

60. (Original) The method of claim 53 wherein said epoxidation reactions are carried out at a pH within the range from about 7.0 to about 12.0.

61. (Original) The method of claim 60 wherein said pH is within the range from 7.0 to 7.5.

62. (Original) The method of claim 60 wherein said pH is controlled by using a pH-stat or a buffer.

63. (Currently Amended) The method of claim 62 wherein said buffer is selected from the group consisting of sodium bicarbonate, sodium carbonate, sodium borate, sodium hydrogenphosphate, sodium dihydrogenphosphate, sodium hydroxide, potassium hydrogenphosphate, potassium dihydrogenphosphate, potassium bicarbonate, potassium carbonate, potassium hydroxide, ~~or~~and mixtures thereof.